Deep Routeing and the Making of 'Maritime Motorways': Beyond surficial geographies of connection for governing global shipping

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Abstract

Geography has turned to towards the seas and oceans with much attention being paid to 'water worlds' through socio-cultural, political and environmental lenses. Geo-economic analysis in particular, has considered the role of containerisation, the port, and global logistics flows central to the contemporary shipping industry. However, where routeing enters discussion these debates remain 'surficial' with a focus on the rationale of lines of connection which are mapped *onto* the sea (rather than *into* the sea, as a liquid, three-dimensional, motionful space). This paper challenges considerations of ship routeing that only skim the surface. This paper adds *depth* to the discussion. It is argued that ship routeing is not a purely surficial exercise of charting a voyage across seas and oceans. Routes have a *geo*-politics predicted at times on the water's depth, the topography of the ocean floor and seabed and marine resources. Drawing on a variety of examples, notably the traffic routeing scheme – or 'maritime motorway' – governing the flows of shipping in the Dover Strait, UK, this paper brings a 'wet ontology' and three-dimensional analysis to ship routeing. It is contended that such a recognition and discussion of *deep routeing* is necessary to shed light upon the often invisible processes sea that underscore the global logistics flows vital to society and the economy.

Introduction

On Monday 14th August 2017, the flow of shipping traffic into and out of the port of Antwerp, the second largest port in Europe, literally *ground* to the stop. The China Shipping Container Lines (CSCL) vessel, the *MV Jupiter* became 'stuck' in a shallow area – the Bocht van Bath of the River Scheldt – as it left port, enroute for Hamburg with 14,074 containers (Torfs 2017). Resulting from a mechanical failure which impacted the ability of the captain to manoeuvre the ship correctly, the ship, travelling at 12 knots, ran aground on the shallow bank avoiding what could have been a much larger disaster. Without the sandbank to halt the vessel, it was on course to plough into the small riverside village of Bath (Torfs 2017). Yet its grounding was disaster enough. The vessel, of 155,000 gross tonnes and 366 meters in length had blocked the main arterial thoroughfare in to the Port of Antwerp (Voytenko 2017). Such was the size of the vessel that traffic in the area had to be 'suspended with more than 10 inward and outward vessels blocked' in the process (ibid. 2017).

Containers and the increasingly large ships that transport them at sea are the behemoths of the global economy. The integrative system of cargo transportation devised by Malcolm McLean in the late 1950s would change the speed and efficiency of global logistics and fuel the 'just-in-time' economy (Birtchnell, Savitzky and Urry 2015, 5), which is now central to our daily existence (Levinson 2016; Martin 2016). Indeed, almost everything we own – approximately '90 percent' of goods – move A to B via ships (George 2013). This is alongside the increased size of bulk carriers such as tankers that carry the raw materials also vital to everyday life. Any breakdown in this global infrastructural system of containerised vessels and bulk carriers due to disabled routes has severe ramifications for our world of global connections. It impacts the movement and subsequent delivery and supply of goods that underscore contemporary society and the economy. The incident in Antwerp was significant because, occurring at low tide – and with a first re-floating attempt failing – it would be a twelve hour wait for the gravitational pull of the moon in respect of these European waters, to offer a high tide to shift and move the vessel. Indeed, surrounded by tugs to secure the *Jupiter*, and a team of port operators working out how and when the vessel could be re-floated, the channel was passable – for what is in 'shipping-time' a *long* time – to only smaller vessels in daylight hours (Torfs 2017).

The blockage created by the grounded vessel was significant, and more so given that globally, not all ports provide route-ways in that can handle the very largest vessels such as the *MV Jupiter*. This meant that those ships of a similar size that were unable to dock in Antwerp during the blockage could not be rerouted. As the Director of Global and European policy at the Freight Transport Association would note on the day of the incident,

> These are very big ships and there are only a relatively small number of ports that can take them, so if there are other ultra large container ships in the Port of Antwerp then clearly that's a problem, they can't get in or out, other ships trying to access the port are also denied that opportunity… the option of switching to other ports is problematic as there are so few ports that can take them… and it becomes a problem if they (the companies) cannot get access to the containers and for the delays that occur in getting the containers and the goods to customers. (Welsh 2017, np)

On the one hand, the incident with the *MV Jupiter* could be read as a story of infrastructural breakdown, analysed through unpacking the failing technology of the ship itself (following Graham and Thrift 2007). On the other hand, it could be considered through unpacking the importance of shipping routes as more than simply flat lines on a map that lead ships across the seas and oceans and through river-ways to port. The incident with the *MV*

Jupiter is a story of a ship that went ‘off-piste’; a ship that deviated from a route causing a grounding with economically catastrophic results. In deviating from a set, governed route, we are alerted that routes, whilst often appearing as lines laid *on* to a map, or on the surface of the sea, relate also to what is *under* sea, at depth. As Torf (2017, np) noted of the Antwerp incident, ‘while the Scheldt estuary may look extremely wide, the passageway for big ships is very small’. Indeed, only a narrow portion of the river is navigable to the very largest of vessels due to variable areas of subsurface depth. From the surface it would be impossible to tell what areas were ‘safe’ and which should be avoided. Indeed, the water’s depth only became apparent when the system failed and the ship hit the solidity of the river bed. The stark materiality of the stranded ship would become a marker of shallow depth.

Developing from this example, this paper contends that more attention must be paid to routeing – to the invisible lanes etched across the oceans, seas – and indeed into inland water courses – that ships forge, form and follow. Routes are as fundamental to globalisation as the material technologies of ships and their cargo. It is ‘safe’ routes – recommended and governed corridors – which invisibly keep ships and their cargo moving. ‘Maritime motorways’ or traffic separation schemes are a particular type of ‘safe’ route that steward shipping in the narrowest and shallowest oceanic ‘bottlenecks’ worldwide (see Peters 2016). The term ‘traffic separation’ refers to the division of vessels into designated ‘lanes’ so that all traffic in a given lane is travelling in the *same* direction (thus preventing head on collisions). However, ships are not just horizontally or surficially separated and ‘spaced’. Traffic separation is also a *vertical* exercise. Maritime motorways are also defined by depth with the aim of separating the invisible subsurface depth of a vessel with the sea floor.

Given that a deviation of a route can ‘break’ a network of flows entirely, wrecking havoc on the just-in-time flows of global shipping, this paper argues the need to take routeing seriously. Yet it also argues we cannot just skim the surface of such an investigation. There is a need to deepen discussions. Indeed, much has been explored in respect of contemporary shipping, ships routes and the global ‘connectivity’ they create (Heins 2015; Hesse and Rodrigue 2004; Lobo-Guerrero 2012; Martin 2013; Nooteboom and Rodrigue 2008; Rodrigue and Nooteboom 2010). Moreover, historically, the routes of vessels have been ways of tracking the socio-cultural and political worlds of colonialism and imperialism (Anim-Addo 2014; Armitage and Braddick 2002; Featherstone 2005; Lambert 2005; Ogborn 2005). Yet the very nature of what a route *is* remains unquestioned. Routes are taken for granted as stubbornly surficial phenomena; fixed lines marked across a surface (Steinberg 1999). But the sea is not just a surface. As Steinberg and Peters have noted (2015, 248), the sea is ‘indisputably voluminous, stubbornly material, and unmistakably undergoing continual reformation’. Although it is vital to take surfaces seriously, for they too have different “subtles”, “densities” and “varieties” (see Forsyth et al. 2013), the sea has *three-dimensional* depth; it has material form as (most often, but not always) a liquid; and it is in constant motion (see also Bear and Eden 2008; Peters 2012; Phillips 2018; Squire 2017). If we apply a so-called ‘wet ontology’ to an understanding of routeing, how might we rethink vessel routeing and in turn the *geo*-economics of global connection and more so, the *geo*politics and governance of how ships then navigate these routes in our seas, oceans and waterways?

Accordingly, the paper will unfold in the following way. Next, a theoretical context to the discussion will be provided. It will begin with an overview of the growth of global shipping in the middle of the twentieth century and the challenges this process has created for ship routeing in respect of depth, before outlining previous work on the sea and routeing that has been predominantly ‘surficial’ – focused on networks, flows and lines of connections. Following from this, the paper will draw from three years of research into ship routeing in the Dover Strait, UK to deepen the discussion of ship routeing. It was here in the Dover Strait that the first Traffic Separation Scheme (TSS) or ‘maritime motorway’ routeing system was designed and implemented. Using this example, the fundamental role of routes as drivers of the global economy will be demonstrated. Moreover, it will be argued that there is a need to see such routes 'in 3D' – as predicated on understandings of variable depth and sub-surface hazards. The research conducted consisted of extensive archival work tracing the transnational formation of traffic routeing measures in Dover (which were subsequently replicated worldwide – albeit differently depending on the waterway concerned and its specific underwater bathymetry, tidal depth and in relation to maximum ship draught). This was using files from the Foreign Commonwealth Office, Department of Trade and Industry and Ministry of Defence (held in the National Archives, UK), together with records from the Lloyds Shipping Register; Dover Local Studies Collection and the library of the Royal Institute of Navigation (RIN). This archival work was alongside observations at the Maritime Coastguard Agency and interviews with staff who monitor the globally significant 'motorway' through 'the Channel', as well as those responsible for major ports that line the way. This example will unpack and posit the value of thinking with a 'wet ontology' – of thinking through water's depth, liquidity and motion – to better make sense of contemporary shipping and how it functions to bring us that '90 percent' of everything (George 2013).

Global shipping and the predominance of surficial approaches to routeing

Recent work in geography has sought to pay attention to water worlds, sea-based mobilities and the fluid spaces of maritime transit (see Anderson and Peters 2014; Anim-Addo, Hasty and Peters 2014; Steinberg 2009). Yet such studies have focused largely on the stubbornly material technologies of ships and the material cargo that is moved (Birtchnell, Savitzky and Urry. 2015; Hasty and Peters 2012), rather than that which can't be so obviously seen – the routes such ships follow – often recommended or enforced – to ensure those ships and their cargo travel as safely and securely in the sometimes physically and politically volatile space of the sea. That there has been such a predominant focus on ships, cargo – and notably containers – is unsurprising. By the mid-1960s 'the world... (had) become organised in a different way' (Parker 2013, 370) – this because of the growth in global shipping and the invention of the container: a box of standard dimensions. Of course, commodities have always moved globally via ships – from the movements of gifts of exchange made by pre-modern societies in the Pacific Ocean (Malinowski 1921), to the global trade in slaves across the Atlantic from the 1700s (Rediker 2007), to convict transportation from the UK and Ireland to Australia (Peters and Turner 2015), to the many goods shifted as worldwide links opened up by the technologies of sail, and then steam and then oil. But the container – or what Birtchnell, Savitzky and Urry call 'Cargo Mobilities' (2015) have radically assisted in the shrinkage of the world (Massey 2001). The container would eradicate the labour intensiveness, time and cost, of loading and unloading ships compared to the era preceding its invention (Martin 2016). The container – or TEU (Twenty-foot Equivalent Unit) has revolutionised the movement of goods creating new surfaces of connection (Levinson 2016). By loading goods into a standard 'box', more goods can now be transported more efficiently. Moreover, the 'compatibility' of the box, which has standardised dimensions with uniform interlocking corners, means boxes can be easily stacked together onto ships, thus maximising space available, before then being transferred by cranes to trains and trucks also configured for the smooth transfer of containers. The system reduces the 'dead time' in the transporting of goods, as they move continuously from ship, to shore (Birtchnell, Savitzky and Urry 2015, 5). As Heins has summarises then 'containizeration helps make our world, at least in terms of economics, trade and commerce, into a more unified and cohesive entity' (Heins 2015, 346).

Whilst the growing volume of geographic work on containers has been important, it has obscured other maritime processes essential to how global (maritime) trade operates. Deborah Cowen (2014) has disrupted the notion that things 'just' move in the containerised world by exposing the harsh labour violations that are bound up with the global shipping trade, especially in a world where what happens, out at sea, is often invisible and obscured, and where even with the presence of flag nation protection and international law, rules and regulations are flouted offshore (Urry 2014; Peters 2011). Martin has likewise showed how such smooth efficiencies allow for easy infiltration for smuggling (2016). This paper disrupts existing work further.

Firstly, although an incredibly simple technological development (Martin 2016, 32), much attention has been directed to the 'box' as the driver of global trade, given they are, as Parker describes, such 'iconic', 'material', 'things' (2013, 382). This has resulted in an omission in much geographic literature regarding the crucial role of bulk carriers – which are the predominant 'movers' of global trade[1] (Peters 2016). In turn, this paper pays attention to a range of vessels fundamental to the '90 per cent' of everything that moves (George 2013).

Secondly, literature on containerisation has been fundamental in creating the '2D' or surficial ontology that dominates understandings of how vessels voyage around our world. As Martin (2013) and Nooteboom and Rodrigue (2008) explain, containerised transport is predicated on eliminating friction and creating smooth 'surfaces' of integration between land and sea – truck, train and ship – to create a connected network where things move "seamlessly" across space (Martin 2013). Containerisation, Martin posits, creates a 'global *surface*' of connection (2013, 1023, emphasis added). Whilst a careful reading of Martin reveals that this surface is a product of eliminating frictions, which includes eradicating a lack of depth that prevents smooth flows (notably shifting ports from shallower areas that bigger container vessels cannot access to deeper, 'out of town' ports, ibid. 2013, 1022), the argument remains that global shipping has created a flat ontology of connection and an understanding of global

[1] In 2010, only about 23 per cent of the 90 per cent of trade moved by ships is moved by container. The majority of goods shifted are 'bulk' including liquid bulk movement (oil) and dry goods (such as grain) (World Ocean Review 2010).

trade as driven by surficial flows. This has dominated much work on the seas and oceans more generally. Indeed, as Steinberg notes, maps of the ocean illustrate it as ‘blue, flat and unchanging: stable in both space and time’ (2013, 159). Moreover, from the era of industrial capitalism when the seas opened-up to more intense trading, they would become ‘idealized as … empty transportation surface(s)’ to be crossed as quickly as possible for capitalist gain’ (Steinberg 2001, 113). This understanding of the seas has dominated until quite recently (Steinberg and Peters 2015).

Thirdly then, whilst this ‘flat ontology’ (to borrow from Marston, Jones and Woodward 2005), has been a common feature of work on maritime flows, networks and connections (both in historical and contemporary work, Lobo-Guerrero 2012; Martin 2013; Nooteboom and Rodrigue 2008; Ogborn 2005; Rodrigue and Nooteboom 2010), an explicit discussion of *routes* or *routeing* has been oddly absent, or bundled up with the surficial discussions of global linkages that create the global ‘“conveyor belt”’ of trade (Airriess 2001, 236, in Martin 2013, 1022). In sum then, it is the container, the ship, and its connected technologies that have been taken, almost indisputably, to ‘make our global world’ (to borrow from Heins 2015, 246). It is these that forge and form our world of connection through seamless, surficial travel. It is *ships* that bring us every item we wear; shoes on our feet, watch on our wrist, phone in our pocket, food on our plate, car that we drive (Peters 2010). Yet all of this renders the role of *routes* – and such routes as anything other than surficial – invisible in understandings of global connection (Peters 2016). Arguably containerisation, alongside increases in bulk and tanker shipping movements, have brought with it busier seas with bigger, faster ships. This presents a greater threat of collision with other ships and with subsurface geophysical hazards – in turn weakening and slowing down supply chain linkages. Moreover, bigger ships have deeper draughts to ensure the correct balance and weighting with cargo or ballast. These ships cannot access all ports, nor travel smoothly through all waterways as the earlier example of the *Jupiter* proved (see also Sys et al. 2008 on the relations between ship size and port operations). Acknowledging *routes* – and moreover *routes as more-than-surficial* – is essential to making sense of our global world of connection – contributing to and theoretically *deepening* debate beyond the visual and material; beyond the ship and its load.

Work that considers the depth of the seas is currently taking hold. Although studies of oceanic depth – or bathymetry – has long featured in the physical sciences (as well as benthic studies of populations under the water's surface, see Hillebrand et al. 2010), alongside studies in engineering and design, operations and management which have attended to technical elements of ship draught (or depth) in relation to trade and port access (Sys et al. 2008; Veldman et al. 2005), in recent years geographers have sought to explore human and more-than-human geographies below the surface of the water, with a variety of underwater (Merchant 2014), immersive (Squire 2017) geographies. Topics of study have stretched from embodied geographies of touristic experience (Straughan 2012; Nash 2013), to the territories of underwater employed in Cold War geopolitics (Squire 2016, 2018). Further work has considered the importance of non-human underwater-worlds; of fish (Bear and Eden 2008), to even the smallest of microbial life (Helmrich 2009). More recently, scholars have attended to resource extraction from under the surface of the seas (see Bond, Diprose and Thomas 2018; Phillips 2018). In this respect, a 3D perspective can add much to our understandings of crucial 'goings-on' at sea. As Peters has written,

> There is certainly potential to consider the underwater in a myriad of ways (through imaginative accounts, shipwrecks or consumption practices) and these possibilities can only (literally) deepen our social and cultural understanding of the world. (Peters 2010, 1268).

However, routeing as an expression of the navigational ordering of space and the harnessing of control of the ocean has remained a largely at surface-level for the geographers who are increasingly seeking to make sense of various political, economic and socio-cultural human engagements with water-worlds (Anderson and Peters 2014).

That said, 'deeper' work has already taken hold in studies of other elemental spaces through which movement happens. This has followed the 'opening up' of a vertical axis in recent geographic thinking – upwards to the sky, and downwards to the sub-terrain – challenging the long held horizontal or 'areal' bias of the much spatial understanding (see Adey 2010; Elden 2013; Graham and Hewitt 2013; Weizman 2003). In Elden's pivotal work (2013, 35, my emphasis) he asks, how thinking with 'height and depth *instead of surfaces'* can unlock new knowledge of spatial politics. In this provocative and important piece, Elden (2013) urges scholars to think with 'volume'. Here there is not a binary division between horizontal and vertical, above or below, surface or sub-surface. Rather, space is configured in '3D' (Bridge 2013).

In Weiqiang Lin's work on air traffic routeing he adopts this '3D' ontology (following from Elden 2013 and building on Adey 2010) to make sense of the ordering of global airplane transportation (2016a, 2016b, 2014). Aeroplanes do not, as Lin notes, simply move through the sky at a set level. The skies are populated by working out 'aircraft separation' the horizontal, as well as *vertical* 'gaps' that keep aircraft moving safely – throughout the *volume* of air – to prevent collision (Lin 2018, 42). As Lin explains,

> [i]n an age when the skies are increasingly saturated with aircraft, these buffers re-rationalise airspace as an orderly geometric body with vertical, lateral, and longitudinal error thresholds calculated in terms of the minimum distance required between aircraft

> on top of each other, between aircraft to the side, and between successive aircraft, respectively. (Lin 2018, 42)

By adding a '3D' ontology, or 'aerial ontology' to thinking about travel above us, we can make better sense of how our global world of aviation functions where increasing demand calls for busier skies, and in turn methods of routeing and separation needed to maintain this intensity of transportation.

Although Steinberg and Peters (2015) have taken Elden's call 'to sea' arguing for an attention to volume, movement and materiality in oceanic politics, studies of shipping, routeing and logistics in geography remains largely surficial. The approach Lin has taken to making sense of the air has not been unpacked in relation to the seas. Yet in the maritime world – where oceans are ever busier (as is exemplified when attention is drawn to pinch-points and bottlenecks such as the Straits of Dover, Malacca, Singapore and so on) and where shipping is essential to global trade movements – an attention to movement *beyond* surface, to a '3D' or 'wet ontology', may add much insight into the governance of an industry vital to society and the economy. The paper now turns to such a discussion.

Deepening discussion: subsurface geographies of ship routeing

The Dover Strait: An introduction

The water that lays between Britain and France – 'the Channel', or more specifically, the narrowest point – the Dover Strait – was formed by 'high interglacial sea levels that led to marine flooding of … shallow shelf areas', separating a previously 'connected' continent (Gupta et al. 2017, 2) creating, in recent times, one of the most significant passages of water on the planet (Maritime Coastguard Agency (MCA) 2014). In both World Wars it was a strategic territory to defend and control, and in peace-time has become a fundamental space of trade and commerce (Unwin 2003). Linking northern Europe and the Atlantic World, providing a funnel to the coasts of the Americas and Africa, it has always been, and still remains, one the major global waterways for shipping traffic (MCA 2014). Over 400 vessels above 300 gross tonnes negotiate it daily (MCA 2014) on a north-south, south-north through-passage. This is in addition to frequent west-east, east-west ferry crossings, the navigation of small crafts, and the presence of dinghies and unorthodox use (such as cross Channel swimmers). In addition to the volume of traffic that moves through the area, which at its narrowest is '18 nautical miles' (Kaimes Beasley MCA, Interview 2016), the Dover Strait, due to its formation is, at points, incredibly shallow. A number of long sandbanks litter the Channel, including the Sandettié, Varne and Bullock Banks; the Goodwin Sands, South Falls and Ruytingen. As Kaimes Beasley, Maritime Operations Controller at the MCA noted, these 'topographical features' alongside the 'sheer numbers' creates a number of 'risk factors' (Interview 2016). The major risk is of collision – with another vessel in the crowded waterway or with a sub-surface, invisible hazard – a sandbank or ridge.

Consequently, the passageway through the Dover Strait is ordered through a routeing mechanism known as a 'Traffic Separation Scheme' (TSS) or 'maritime motorway', dividing shipping traffic into two streams (MCA 2014). Traffic heading south-west to the Atlantic is channelled adjacent to the British coast. Traffic heading north-east to the ports of Europe is routed adjacent to the French coast. The scheme is mandatory for all vessels over 300 tonnes that are traversing the Channel. That a mandatory scheme for routeing exists in the Dover Strait raises questions of territorial governance, given its status as an 'international' waterway and thus not subject to the laws governing either Britain or France, but those of the United National Law of the Sea (UNCLOS). Although maps depicting the TSS illustrate it as a flat maritime motorway, with two-dimensional surface lanes, the routeing scheme was devised, negotiated and now operates based not just on movements 'across' the water, but *through* it. It was a scheme predicated on depth. In the remainder of this section, the development of the world's first TSS or maritime motorway will be unpacked. Routeing, it will be showed, is not just a surface-level, horizontal exercise of splitting shipping traffic into lanes. It is an exercise that relies on understanding the very *volume* of space, and the sea as liquid, wet and motionful (following Steinberg and Peters 2015).

From lines to conduits: Creating 3D Dover Strait flow-space

There are now over 400 TSS or maritime motorways world-wide. These routeing schemes *under*score the movements of containerised and bulk vessels, ensuring they travel with maximum efficiency, avoiding the risks that are associated with particular global waterways. The Dover Strait was the first of these schemes and provided the blueprint for all which would follow. This 'blueprint' functions by way of setting out the concept of 'traffic separation' and the rules under which it must operate in international shipping straits. However, each motorway is also very different, with the specific route determined by the geophysical traits of a given passage (its twists, turns, bends, length), the topography or bathymetry of the seabed (depth and its character), meteorological and tidal conditions, the volume of shipping and so on. These will each impact the exact motorway 'route', devised and implemented in a given 'volume' of water.

The Dover Strait became the testing-space for the first motorway routeing scheme because of its unique conditions. As Kaimes Beasley of the Maritime Coastguard Agency stated 'when you look at the reasons why a Traffic Separation Scheme was established in the first instance', it was because it met a distinct 'set of criteria' (Interview 2016). The Dover Strait is narrow, busy, has changeable weather, is prone to fog, and it has hidden, subsurface dangers (Kaimes Beasley MCA, Interview 2016). Unofficial forms of routeing have long existed in the Channel, for example, the 'Nemedri Routes', which are a set of passages through the Channel that had been ‘mine swept’ following both World Wars, to create safe (sub/surface) passage for vessels in respect of the threat of unexploded bombs. Yet the advent of larger ships and busier seas would make formalised routeing in maritime bottlenecks more urgent.

In 1967, Britain – and indeed the world – faced the worst maritime incident ever witnessed when the *SS Torrey Canyon*, a Suezmax Class oil tanker which could carry 120,000 tons of crude oil, struck the shallow Seven Stones reef near the Isles of Scilly, where it was grounded and then broke up, spilling its load (Oudet 1972). This was a disaster due to specific subsurface, invisible hazards. On colliding with the reef, the spill from the vessel reached far and wide, contaminating the coast and killing many thousands of seabirds and other marine life (ibid. 1972). As Captain Oudet, who would later be pivotal in the design of TSS/maritime motorway stated,

> *Torrey Canyon* was sailing in dangerous waters where she had no business to be. It was suggested that tankers and other very large ships should be confined to routes free from danger, that the courses actually made good should be properly checked and that speed limits should be imposed. (Oudet 1972, 56)

The need for routeing through the Channel and Dover Strait gained momentum following this disaster. As early as 1959, Captain Oudet had set out an agenda for the need to consider the routing of traffic in the Straits of Dover/Pas De Calais (National Archives BT 243/177). But in the 1960s this effort was directed through the work of the Royal Institute of Navigation (RIN). Discussions were held by a pan-European Working Group lead by Michael Richey, director of the RIN, together with interested parties from across Europe, primarily the Britain, France and what was then West Germany. The Working Group was an independent committee who aimed to deliver established and agreed proposals to respective governments and thereafter to the International Maritime Consultative Organisation (IMCO) for implementation. Given the political contestation over sea-space – and Britain's desire to not encroach the freedom of navigation at sea (Peters 2011) – governments were content to take a backseat until a suitable proposal for Channel routeing presented itself to them. The outcome was an optional TSS, aimed to recommend motorway routes to seafarers based on the system of two channels – south-west and north-east – creating single-flow traffic lanes, and crucially lanes that avoided the treacherous shallow banks such as Sandettié and Varne (see National Archives BT 243 files). Indeed, by 1962 alone, when the world was opening up to improved flows of efficiency through containerised and bulk shipping via larger ships with deeper draughts, over 80% of shipping through-traffic in the Channel navigated an area of less than 5 miles wide because of such sub-surface hazards (National Archives BT 243/177). As such, the TSS designed by the Working Group was not a design of lines etched *onto* a map and on to the sea. It was the carving of a safe conduit through the very volume of space.

Whilst optional, the Dover scheme presented few issues in light of who would oversee its use. Being optional meant there was no mechanism to record a contravention or put in place a penalty for incorrect usage. Whilst some ships did voyage in the new, recommended way, collisions still occurred (see the 520.02 files series held by RIN). The threat of subsurface hazards would become evident again in 1971 when, on the evening of Monday 11th January, a serious maritime collision occurred in the Dover Strait, six miles offshore from Folkestone. The Panamanian registered motor vessel *Texaco Caribbean*, weighing in at 13,604 gross tonnes and set for Trindad with ballast collided 'about seven miles off Folkestone... with the Peruvian vessel *Paracras* (9,481) which was eastbound on a voyage from Pisco in Peru to Rotterdam' (Lane 1996, 3, from the Dover Local Studies Collection, D38). The 'result was an enormous explosion which tore the tanker in half and rocked homes from Dungeness to Margate' (ibid. 1996, 3). The *Paracras* was taken by tow to safety, but the *Texaco Caribbean* would be lost.

After the incident the vessel laid, part sub-merged and over the course of 10 hours sank – in two separate parts – 'right in the middle of the main shipping lane at a point where it was at its narrowest due to the Varne sandbank' (ibid. 1996, 4). In the dim and fog-obscured morning light on the 12th January, unable to see the part-submerged wreckage of the previous day, the German vessel *Brandenburg* was involved in a further collision with this subsurface hazard (National Archives, FCO 76/252). The vessel was to sink in the vicinity of the earlier accidents and all 21 crew members died[2].

The 1971 incidents resulted in a growing momentum for routeing through the Dover Strait that would prevent such accidents occurring. Crucial would be a shift from an optional scheme directing travel, to a *mandatory* system of lanes. Yet making such a scheme compulsory raised new, contentious geopolitical questions over who was responsible for ocean space and who could rightfully impose penal provisions if such a scheme was contravened. If penalties were enforced by the nation-state adjacent to the sea where the scheme was located, observed and monitored – and over a ship of a different national flag – this would be tantamount to an extension of sovereign state powers into the international space of the sea. As the topic of TSS shifted from the RIN to the government, matters of routeing remained concerned not just with 'surface' matters, but with complexities that were far deeper.

A geopolitical struggle: Making mandatory deep routeing

Directing vessels in a mandatory fashion by means of lanes, predicated on circumnavigating hidden underwater hazards and separating out traffic (much akin to aerial separation, see Lin 2018), was a key concern of the governments of Britain and France who needed to ensure the

[2] Little over a month later the Greek tanker *Niki* would collide with this wreck, hidden on the sea floor. A further 22 seafarers died. This succession of accidents was the worse set of maritime casualties in the Dover Strait during peace time. It remains to this day, the largest loss of life post-World War Two in the Channel.

scheme was adhered to, but did not want to be seen to impose orders to ships flagged to, and thus extensions of, non-British and French territories (Benton 2009). Such ordering would be an extension of state power to the 'high seas' (see also Peters 2011). As the Ministry of Defence (MoD) reported to the Foreign Commonwealth Office (FCO) 'issues might arise in making the current optional use of traffic lanes mandatory in view of territorial claims over water' (Memo correspondence, 28th January 1971, National Archives FCO 76/ 252). As Mr Campbell of the Department of Trade and Industry (DTI) warned a few days later, 'a mandatory reporting scheme' (where Britain or France monitor and report on contravening vessels) might be considered as 'unilateral extensions of British and French sovereignty over the Channel. Although the British government are not thinking in these terms' it may well be deemed that they are (Memo correspondence, 28th January, National Archives FCO 76 252). The British and French were concerned at exercising control *deep into* another territorial domain – that of the 'free seas'. To alleviate this concern, they devised a surveillance system that would allow traffic to be 'monitored' by the British and French from radar stations either side of the Strait, with operators *referring* any contravention of route usage to the flag nation of the ship. This deferred responsibility to the nation-state for which the ship was registered. Such a method of enacting control removed any doubt that Britain or France sought to make sovereign claims via 3D TSS zones or through wet, liquid, motorway routes.

Yet there was a second matter to resolve. The Dover Strait was not (and is not) just a space of (sub)surface flows of transportation. Other activities aside from 'transiting' occur – notably fishing. The English Channel, North Sea, and Dover Strait have long been important fishing grounds and political resistance followed with concern from organisations that their access to this underwater resource would be limited with the imposition of mandatory lanes. As early as 1963 with the discussion of optional lanes the English Herring Catchers Association noted that,

> Traffic Regulation … would greatly interfere with the Drift net fishing for Herrings of the English and Scottish Herring Drifters …. The East bound route covers practically all the North and West Hinder grounds, Sandettié and Outer Ruytingen grounds and a large part of the fishing area near Cape Gris Nez. (Letter from Mr Catchpole to the Working Group, March 1963, National Archives BT 243/178)

Later in 1968 (National Archives BT 243/611) and again in 1971 (National Archives FCO 76/254) the rights of fishers to their subsurface catch was again 'raised'. As Bear and Eden note, fish move underwater and fail to respect boundaries (2008). Catch would move into and out of the TSS zone, through the motorway lanes. In 1968 Mr Parker of the Ministry of Transport (MoT) noted that there may be the need to 'flexibility' in the rigid scheme of routeing,

> …fishing vessels… pleasure vessels and similar craft should avoid hampering vessels using Traffic Separation Schemes… At the session we somewhat tentatively suggested that some flexibility might be injected …. We thought we might be in the minority … but to our surprise a number of delegates expressed the view (that this was) discriminatory against certain classes of vessels. (Mr Parker, report of the 6th session of the IMCO Safety of Navigation Committee, National Archives BT 243/611)

Given the complexities regarding fishing, the regulations for routeing as eventually set out in the guiding document for TSS 'The International Regulations for Preventing Collisions at Sea' (or 'COLREGs') (initially 1972, latest amendment 2008), paid special attention to the rights of fishers, noting, 2.8 Vessels fishing within a Scheme are considered to be using the Scheme, and must comply with the general requirements set out in Rules 10(b) and (c)[3], however, when fishing in a separation zone they may follow any course.

2.9 The requirement that vessels fishing must not impede the passage of traffic passing through a TSS, means that they must not operate in such a manner that neither they, nor their gear, seriously restricts the sea room available to other vessels within a lane, and must take early and substantial action to avoid any risk of collision developing. (COLREGS, in Marine Guidance Note 364, 2008, 2)

Accordingly, having debated issues at 'depth' the proposal for mandatory routeing was adopted for agreement by the International Maritime Consultative Organisation (IMCO, now known as the IMO) in 1972 and laid down in international collision regulations (COLREGS rule 10) and in national-level maritime guidance notes world-over.

But the scheme devised in the 1970s is still subject to amendment and depth has been crucial to 'tweaks' and 'additions' to the Dover TSS. Again, as early as 1968, there had been concern that some aspects of the routes proposed would have 'insufficient deep water' to facilitate the transit of the largest, deep-draught vessels (letter from Mr Parker of the MoT to Mr Tordjman (his counterpart in France), 10th September 1968, National Archives BT

[3]Rule (b) states 'a vessel using a traffic separation scheme shall: (i) proceed in the appropriate traffic lane in the general direction of traffic flow for that lane; (ii) so far as practicable keep clear of a traffic separation line or separation zone; (iii) normally join or leave a traffic lane at the termination of the lane, but when joining or leaving from either side shall do so at as small an angle to the general direction of traffic flow as practicable' (COLREGS 2008, 7). Rule (c) states 'a vessel shall, so far as practicable, avoid crossing traffic lanes but if obliged to do so shall cross on a heading as nearly as practicable at right angles to the general direction' (ibid 2008, 7).

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243/611). In 1970, Mr Ordman of the Port of London Authority, would write to the DTI regarding the 'reversal' of TSS routing which some were in favour of 'because under the present routeing very deep-drafted ships bound for Holland or Germany have to pass east of Sandettié … with the increase in drafts of tankers greater depths of water area required than hitherto. Owing to sand-wave formation east of Sandettié, the depths required are not available' (14th December 1970, National Archives BT 243/613). As a 'Forum' article from the *Journal of the Institute of Navigation* relayed,

> …the requirements for safe navigation of ships now in service [in 1970] bear little resemblance to the requirements of 1964, when the present routes were formulated. One of the main difficulties have been that of the dramatic increase in draught but this was predictable and should have been allowed for, indeed, Lloyds had anticipated draughts of 72ft for 250,000 ton ships before routing started…. Bearing in mind that tonnages and draughts will inevitably increase in the future, the requirements of the deep inwards ship must be given first consideration. (October 1970, National Archives BT 243/613)

Although there was much discussion of route 'reversals' in the Dover Strait to account for ship routeing of larger, deeper-draught vessels, a 'Note by the Government of the Netherlands' on the navigation of deep-draught ships through the Dover Strait would argue, along with the Working Group of the RIN, that 'a radical change in the routeing system of Dover Strait is not desirable, The general traffic pattern in the area in question is working satisfactorily' (see also National Archives file series FCO 76). The Netherlands note went on to state that 'the conclusion was reached that it is desirable to establish for vessels with a draught in excess of 55 feet a route West of the Sandettié bank'. Indeed, the development of a DWR or 'Deep Water

Route' would be established for the transit of 'ultra' sized vessels ensuring their safe passage. This is now set out in COLREGS,

> 4.9 The main traffic lane for NE-bound traffic lies to the SE of the Sandettié Bank and should be followed by all such ships as can safely navigate therein having regard to their draught.
>
> 4.10 The deep-water route to the NW of the Sandettié Bank is intended for use by vessels with a draught of 16 metres or more. Masters considering using this route should take into account the proximity of traffic using the SW-bound lane. Through traffic to which this consideration does not apply should, if practicable, avoid using the deep-water route. (COLREGS, in Marine Guidance Note 364, 2008, 5, see also UK Hydrographic Office Dover Strait DWR, 2013).

Paving the way below: Voyaging toward conclusions

The Maritime Coastguard Agency at Dover, along with colleagues in Gris Nez, France, 24 hours a day, 7 days a week, now ensure the 'proper' usage of lanes in the Strait (Visit to MCA, July 2016). They operate in such a way that does not interfere with the authority of the ships' captain, or with the legal status of the maritime motorway in international waters. They do so through a process of observing, monitoring and reporting on traffic entering the Dover Traffic Separation Scheme. They ensure mandatory compliance through operating an information service to seafarers, alerting them to any dangers they may face in the Channel: a broken-down vessel, poor visibility hidden risks below the surface, and so on. They also operate a system whereby ships must report to operators at Dover, outlining their intent in transiting the Strait. Once in the lane, they must abide to regulations set out in COLREGS that govern the flow of traffic. The route allows ships to avoid key shallow areas that litter the Strait, and to proceed safely and smoothly through the Channel in the same direction as other traffic. Operators watch the traffic, diligently, expertly, pre-emptively (following Anderson 2010), through a combination of radar and AIS data, anticipating vessel movements in relation to each other, and areas of hidden depth – the Varne Bank being one notable one – providing information that can prevent collisions (Visit to MCA, July 2016). The screen from which operators observe and monitor 'may look flat, its icons two-dimensional, but they mark a three-dimensional world, indicating patches of weather above the seas surface, and sandbanks and wrecks below it' (Visit to MCA, July 2016).

If a ship fails to check in with the relevant coastal authority, or a vessel contravenes the rules of roads – a report is logged. To this day, this system works. As Kaimes Beasley from the Maritime Coastguard Agency would note,

> you can say, now it is in place that there is a massive reduction in the number of collisions (and)… that is down to a number of factors – a combination of the number of improvements to the regulatory regime for safety and an improvement in the technology we have at our disposal. But it is also the Traffic Separation Scheme in reducing the chance of collision. (Interview 2016)

This has also been confirmed in official surveys of Channel usage. As early as 1977, a series of surveys by the Anglo French Safety of Navigation Group (AFSONG) set up to study the behaviour of Channel traffic noted,

> A substantial reduction in casualty figures and the acceptance by the mariner of disciplined use of the Dover Strait Traffic Separation Scheme has resulted… (the)

extended research (of Britain and France) contributed much to this achievement (AFSONG, Study of Marine Traffic in the English Channel June 1977, 1, RIN Archives, 520.02/11)

Routeing, in sum, has been crucial to the efficient, safe and secure movement of vessels through the Dover Strait. In relaying the history of 'Channel' routeing and the making of a maritime motorway this paper has aimed to achieve two goals. First, to add depth – or *volume* – to predominantly surficial studies of routeing, and second, to centralise the study of routeing per se in geographical analysis where it has been overlooked in favour of the highly visual and firmly material markers of the global economy – 'ships' and 'stuff' (see for example George 2013; Heins 2015; Martin 2016; Parker 2015).

Routeing, as has been demonstrated, is not secondary to ships and cargo as a key driver of global trade and commerce. Rather it is the underlying 'invisible infrastructure' – or *route* (Peters 2016) that secures the movement that is fundamental to the globalised world. This paper has illustrated what might be learned by approaching these vital routes through the framework of a 'wet', three-dimensional' spatial ontology (Steinberg and Peters 2015). It has showed how ship routeing is not a purely surficial exercise of charting a voyage *across* seas, oceans and waterways, but rather, routes are predicted at times, on the water's depth in relation to surface. Routes are devised by thinking of space as voluminous. The topography of the ocean floor and seabed, as well as the underwater resources at stake in maritime space all matter to processes of routeing. Likewise, early, pre-industrial routes were determined not just as lines on a map, but by spherical, voluminous planetary conditions of wind speed and direction which would drive sails. In this example of 'deep routeing' and the making of maritime motorways, thinking beyond surface and with volume has been essential in matters of governance, to ensure vessel safety and security so that movement doesn't ground to a halt and the economy with it.

Whilst the Dover Strait is an important example – the space where one of the most pivotal formalised routeing measures was formulated and developed – other examples demonstrate the central place of managing and governing the transit of vessels to ensure they safely and securely move from A to B. In 2010, for example, the United States Coast Guard (USCG) began a consultation regarding the implementation of a TSS routeing scheme for the Bering Strait, a stretch of water between the north western tip of Alaska and Russia, argued to offer a new, globally significant passageway for vessels with the advent of ice melt (Huntington et al. 2015). Yet the process has been slow. This is in part due to concerns over a rigid vessel traffic scheme in a 'dynamic' maritime area (Captain Ed Page, Marine Exchange Alaska, Interview 2016). 'Indigenous' fishing is conducted in the area which falls across suggested 'motorway' paths, and ice melt – and particularly the presence of floes – can cause mobile hazards under and above the water. As such, any routeing must account for these subsurface considerations. As the Director of the Marine Exchange stated,

> And so if your route, your channel that you describe is right where the ice is, they (the captains) are going to go one side or the other, they're not going to go through the ice … sometimes there is a whale, a pod of whales, or whalers for that matter … (So) what I think is more appropriate, in light of the new technology that we now have going forward … I think for the Bering Strait, which is forty eight miles wide, what you really want us to identify is 'Areas to be Avoided'. (Captain Ed Page, Marine Exchange Alaska, Interview 2016)

A dynamic 'Area to be Avoided' refers to a specific 'known' zone seafarers should not passage through (leaving the remainder of sea-space for navigation by the Captain, as is deemed suitable). It is a method of governing the route of vessels away from dangers but not determining the route as rigidly as a motorway. Even this mode of routeing, however, is determined by not just an areal, flat, zone or 'area' on a map. It is established by an understanding of *depth*, of volume and of the sea as dynamic and mobile (following Steinberg and Peters 2015) in order to route vessels away from hazards. A scheme also predicated on depth has been implemented in New Zealand to prevent the strikes of whales as large vessels enter the Hauraki Gulf. This has been achieved by creating points *enroute* where vessels must 'slow' their passageway through the water into port (see Constantine et al. 2015). Notably, such 'Areas to be Avoided', route-speed restrictions and TSS are typically represented on maps, as a pink, flat channels or zones. Yet these are anything but flat. Schemes are carefully designed to manage oceanic volume, circumnavigating ships around hidden geophysical dangers, marine life, the dangers of submerged wrecks, as well as reducing the dangers of a head-on collision.

This paper has thus challenged considerations of ship routeing that only skim the surface. Yet much more work is needed to understand routeing and how depth plays a part in the global passageways that are as fundamental to making global mobilities as containers, cargo and the vessels that shift them. How, for example, are changes in sea-level rise monitored and what does this mean for changes to the viability of global shipping? How might deep-sea mining and also underwater nuclear testing alter the pathways of ships? What governance is necessary, or even desirable for underwater research and military vessels? This paper has argued that ship routeing is not purely surficial exercise of charting a voyage across seas and oceans. Routes have a geo-politics predicted at times, on the water's depth, it volume, its movement, the topography of the ocean floor and seabed and marine resources. It is time, therefore, to deepen and bring a wet ontological awareness to understandings of the vital work of routeing measures for improving the safety of life at sea for human, and non-human entities. This paper has argued that a recognition and discussion of *deep routeing* is necessary to shed light upon the governance of the ocean and the invisible processes – and invisible infrastructures such as maritime motorways – that underscore the global logistics flows vital to society and the economy.

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